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The meaning of pain: cancer patients' rating and recall of pain intensity and affect

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Abstract

The present study investigated the influence of an increase in present pain intensity on the rating and recall of the intensity and affective dimensions of clinical pain. Thirty-two cancer patients who reported that movement caused or exacerbated their pain rated their present pain intensity and affect before and after a session of physical therapy. Subjects also rated their usual, highest and lowest pain intensity and pain affect for the previous 3 days, and were randomly assigned to make these ratings either before or after the physical therapy session. Physical therapy increased the intensity ($P < 0.01$) but not the unpleasantness of the pain ($P > 0.05$), thus demonstrating a dissociation between pain intensity and pain affect. Beliefs about pain etiology also influenced post-therapy pain ratings. Subjects ($N = 11$) who believed that their pain was due to cancer, rated their post-therapy pain intensity and pain affect significantly higher than those subjects ($N = 21$) who did not believe their pain was due to cancer (both $P < 0.05$). For all subjects, recall of past pain intensity and affect was positively correlated with present levels of pain intensity and pain affect ($P < 0.01$). Thus, recall was assimilated to present pain levels. The results demonstrate the importance of rating both the intensity and affective dimensions of pain, and suggest that the significance of clinical pain influences pain ratings. These results also suggest that research on the rating and recall of pain, particularly the affective dimension of pain, should use actual patients who are experiencing changes in their naturally occurring pain. © 1998 International Association for the Study of Pain. Published by Elsevier Science B.V.

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1. Introduction

Research in the rating and recall of pain has historically separated pain by its temporal quality into two categories: acute and chronic. However, there are several other distinguishing characteristics between these types of pain and pain studies. Typically, acute pain research relies on healthy normal volunteers undergoing experimentally induced pain. These subjects are given some knowledge and expectations about the experimental pain, and the pain is usually of limited intensity and duration. Subjects are also able to stop their pain at any time. They typically proceed from a pain free state, through an increase in pain, and return to a pain free state. Recall is attempted after the pain is terminated, while the subject is in a pain free state.

In contrast, research in the rating and recall of chronic pain focuses on patients experiencing naturally occurring pain. Unlike subjects in the acute pain studies, these patients have limited knowledge about the course of their pain, lack the ability to stop their pain at any time, and experience pain which often significantly impacts daily living. In these studies, the subjects' present pain is usually reduced by a treatment intervention. Recall is usually done after this reduction in present pain, but while these patients are still experiencing some pain. Research with patients experiencing changes in their naturally occurring pain may describe a completely different phenomenon than experimental studies with normal volunteers.

The present study combines aspects of these two research approaches by examining the effect of an experimentally induced increase in naturally occurring chronic pain on

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the rating and recall of pain. Specifically, this approach created an experimental acute pain episode in patients experiencing clinical chronic pain and allowed us to investigate in a unique manner three issues: (1) the relationship between sensory and affective dimensions of clinical pain; (2) how the beliefs about pain etiology influence sensory and affective ratings; and (3) the effects of an increase in present pain on the recall of past pain intensity and affect.

Most research on the rating and recall of pain evaluates only pain intensity. However, pain has an affective as well as a sensory dimension. The separation of the sensory (intensity) and affective (unpleasantness or distress) dimensions of pain has been well established both statistically and experimentally (Gracely et al., 1978; Gracely, 1979; Gracely and Dubner, 1987; Duncan et al., 1989; Fernandez and Turk, 1992). Perhaps the strongest evidence comes from experimental studies which have shown that certain medications can reduce pain selectively on one dimension and not the other. For example, Gracely and Dubner (1987) asked normal volunteers to describe the sensations evoked by electrical tooth pulp stimulation after the administration of either Fentanyl, Diazepam, or placebo. While the opioid Fentanyl significantly reduced the intensity but not the unpleasantness of the pain sensations, diazepam marginally reduced the unpleasantness but not the intensity of the pain. One goal of the present study was to investigate for the first time whether experimentally-induced increases in pain intensity can occur independently of changes in pain unpleasantness in patients with chronic pain (Fernandez and Turk, 1992).

Perceived degree of threat to health or life can selectively augment the affective dimension of clinical pain (Price et al., 1987). Chronic pain patients who are most likely to demonstrate the influence of present pain affect on rating and recall of pain are those whose pain has the greatest impact on their lives. However, most chronic pain research is with patients whose pain is perhaps unpleasant and life-altering, but not life-threatening. Likewise, laboratory-induced pain, such as cold pressor or thermal pain, is also clearly unpleasant but it generally has no long-term implications for the subject. Research on the appraised meaning of current pain requires investigating patients whose pain has the most significant implications for their lives (Price and Harkins, 1992).

For example, cancer is a progressive, often life-threatening disease in which patients frequently expect and fear severe pain (Greenwald et al., 1987). Present pain affect may be more likely to influence rating and recall of pain in cancer patients. The pain itself may serve to elicit worry about the disease (Easterling and Leventhal, 1989), particularly if the patient perceives the pain to be a symptom of cancer and/or a signal of disease progression. Abdominal pain, for example, is likely to have a very different meaning for someone with a recent diagnosis of stomach cancer than for a well individual (Price and Harkins, 1992). This meaning is based both on the past and the implications for the future, rather than just the current state of unpleasantness. Thus, for cancer patients, the affective dimension and appraised meaning of pain, as well as, perhaps, beliefs about the etiology of their pain, may influence the rating and recall of pain intensity.

We also investigated the effects of present pain state on recall of previous pain. Chronic pain may be particularly difficult to recall accurately, because present pain level influences pain reports (Eich et al., 1985; Erskine et al., 1990). For example, Smith and Safer (1993) in a study with non-cancer outpatients found that a temporary reduction in chronic pain as a result of physical therapy lead patients to remember previous pain as less intense and of shorter duration, and previous medication use as less frequent and more effective. Previous research on pain memory has evaluated recall of chronic or clinical pain after a decrease in present pain level (Roche and Gijsbers, 1986; Smith and Safer, 1993), and recall of acute or experimental pain after an increase in present pain level (Hunter et al., 1979; Norvell et al., 1987). In contrast, the present study investigated the effect of a physical therapy-induced increase in clinical pain on reports of chronic pain for the previous 3 days.

The subjects in the present study were 32 cancer patients who reported movement-evoked pain. The patients assessed their present pain intensity, pain affect and mood both before and after a single session of physical therapy. The physical therapy was prescribed for the patient's overall benefit and consisted primarily of exercise and passive stretching. The therapy was not for pain relief, and indeed it was expected to temporarily increase the patient's naturally-occurring, movement-evoked pain. We compared ratings and recall of pain by patients who believed that cancer was directly responsible for their pain versus those who were uncertain about the etiology of their pain or who believed their pain was associated with their treatment (e.g. surgery, consequences of radiation), or a medical condition other than cancer (e.g. arthritis). Those who believe that their pain signals cancer may respond quite differently than the others to the physical therapy-induced pain.

In order to study the influence of present pain on recall for past pain, half the patients recalled their pain intensity and affect immediately before their physical therapy and half just after their therapy. Recall of past pain was expected to be assimilated to present pain levels.

2. Methods

2.1. Subjects

Thirty-two patients who had given written informed consent for experimental cancer treatment protocols at the National Institutes of Health participated in the present study. Eleven patients who were referred for participation did not complete the study, leaving a final sample of 32.

Subjects were admitted as in-patients or out-patients to the Clinical Center hospital for treatment of cancer and referred to the physical therapy program by their physicians for reasons unrelated to immediate pain reduction. Patients ranged in age from 13 to 64 years old (mean = 46.5), and included 14 men and 18 women. The length of time since the patients had been diagnosed with cancer ranged from one month to 144 months (mean = 24.3 months). The principal diagnoses for patients were melanoma ($N = 9$), sarcoma ($N = 6$), breast cancer ($N = 6$), prostate cancer ($N = 4$), lymphoma ($N = 2$), renal cell cancer ($N = 1$), multiple myeloma ($N = 1$), leukemia ($N = 1$), lung cancer ($N = 1$) and ovarian cancer ($N = 1$). All patients reported that movement caused or exacerbated their pain.

Nurses and physical therapists evaluated each patient's gross cognitive function prior to enrolment in the study. Patients who displayed any impairment in cognitive abilities, regardless of medication use, were excluded from the study.

2.2. Questionnaires

Patients rated their present pain, mood, and completed Part 1 of the West Haven–Yale Multidimensional Pain Inventory (WHYMPI) (Kerns et al., 1985). Present pain intensity was measured with an 11-point Likert scale: 0 = 'no pain' to 10 = 'highest pain imaginable'. Present pain affect was measured with an 11-point Likert scale: 0 = 'not unpleasant at all' to 10 = 'as unpleasant as you can imagine'. Present positive mood was measured with an 11-point Likert scale: 0 = 'not at all happy' to 10 = 'extremely happy'. Present negative mood was measured with an 11-point Likert scale: 0 = 'not at all sad' to 10 = 'extremely sad'. Part 1 of the WHYMPI consists of six subscales measuring various psycho-social aspects of pain and functioning.

Patients recalled their past pain intensity, pain affect and mood during the previous 3 days using the identical 11-point scales as described above. The presentation order of the recall scales was counterbalanced across patients.

Pre-Physical Therapy Recall Group
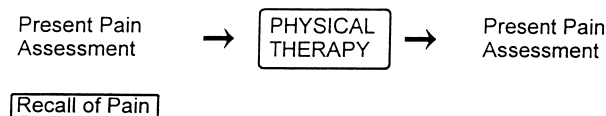
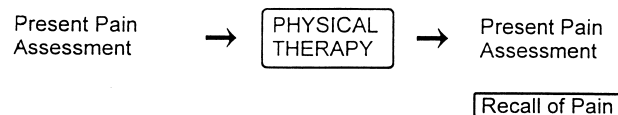#### Post-Physical Therapy Recall Group

Fig. 1. Study design.

2.3. Procedure

Subjects rated their present pain and mood twice, immediately before and immediately after their physical therapy session (see Fig. 1). Subjects recalled their past pain, mood, and completed Part 1 of the WHYMPI only once. Subjects were randomly assigned to recall past pain and mood either before or after their physical therapy session. The Pre-PT Recall group recalled past pain experience and mood prior to their physical therapy session while the Post-PT Recall group recalled past pain experience and mood after their physical therapy session.

3. Results

3.1. Statistical analyses

To assess the effects of physical therapy, a series of *t*-tests were used to compare ratings of pain intensity, pain affect, positive mood and negative mood made before and after physical therapy.

t-Tests and correlations were calculated to analyze the relationship between pain dimensions. To assess the impact of beliefs in etiology of pain, a series of *t*-tests was calculated to compare ratings by subjects who believed their pain was directly related to their cancer with subjects who believed their pain was due to other factors. t-Tests were also used to determine any differences between groups at the time of recall of previous pain, and analyses of covariance were calculated to adjust for both positive and negative mood levels prior to physical therapy. Correlations between recalled pain and present pain levels were calculated to further analyze assimilative effects of present pain.

3.2. Effects of physical therapy

3.2.1. Changes in pain and mood

As expected, ratings of pain intensity before the physical therapy session (mean = 2.47 on the 0–10 point scale) were significantly less than the ratings of pain intensity after physical therapy (mean = 4.47, $t(31) = -5.25$, $P < 0.01$). Pain intensity ratings increased for 27 patients, stayed the same for four patients, and decreased for one patient. In contrast, there was a slight decrease in pain affect ratings from before physical therapy (mean = 2.63) to after physical therapy (mean = 2.16, $t(31) = 1.38$, $P > 0.05$). The physical therapy also affected the patients' mood. Ratings of positive mood increased significantly from before (mean = 5.75) to after physical therapy (mean = 6.47, $t(31) = -2.70$, $P < 0.01$), while ratings of negative mood decreased from before (mean = 3.06) to after physical therapy (mean = 1.97, $t(31) = 3.06$, $P < 0.01$). (see Table 1).

3.2.2. Dissociation of pain intensity and pain affect ratings

The use of paired rating scales enabled evaluation of

Table 1

Effects of physical therapy on present pain and mood for all subjects

	Mean level before PT	Mean level after PT
Pain intensity	2.47	4.47**
Pain affect	2.63	2.16
Positive mood	5.75	6.47*
Negative mood	3.06	1.97**

$*P < 0.05$, $**P < 0.01$, within group differences.

whether physical therapy influenced pain intensity and pain affect differentially. The difference between pain intensity and pain affect ratings was significantly smaller prior to physical therapy (mean $= -0.16$) than the difference after physical therapy (mean $= 2.32$, $t(31) = -6.77$, $P < 0.01$). Prior to physical therapy, ratings of pain intensity (mean $= 2.47$) were not significantly different from ratings of pain affect (mean $= 2.63$, $t(31) = -1.09$, $P > 0.05$), whereas after physical therapy, ratings of pain intensity (mean $= 4.47$) were significantly greater than those of pain affect (mean $= 2.16$, $t(31) = 6.92$, $P < 0.01$) (see Fig. 2). Thus, physical therapy differentially increased the intensity but not the unpleasantness of the pain.

While this result indicates that intensity and unpleasantness are separable dimensions of pain, they are not statistically independent dimensions. Patients' ratings of intensity and unpleasantness were highly correlated both before ($r = 0.96$, $P < 0.01$) and after ($r = 0.72$, $P < 0.01$) physical therapy (see Fig. 2). The possible decrease in correlations may reflect this dissociation of pain intensity and pain affect due to the physical therapy.

3.3. Beliefs about pain etiology

The appraised meaning of pain for its sufferer may influence how that individual responds to increases in pain. The ratings of pain and mood, both before and after physical therapy, by patients who believed that cancer was directly responsible for their pain ($N = 11$) were compared to the
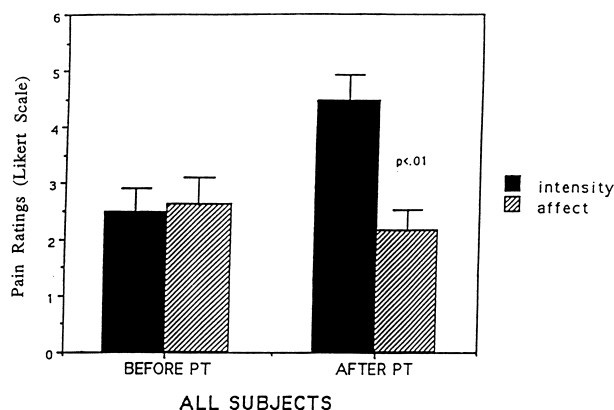
ratings of pain and mood by patients ($N = 21$) who attributed their pain to other factors, such as the effects of their treatment ($N = 19$), and/or a medical condition other than cancer (e.g. arthritis) ($N = 5$), and/or they were uncertain about the etiology of their pain ($N = 3$). The grouping is based on the patient's belief in the etiology of the pain. These beliefs may or may not have been confirmed by physicians. There were no significant differences (all $P > 0.05$) between these two groups of patients in pain intensity, pain affect, positive mood, or negative mood prior to physical therapy, no difference in recall of pain intensity and pain affect for the previous three days, and no differences on any of the WHYMPI, part 1 subscales.

However, significant group differences were apparent in response to the pain-increasing physical therapy (see Fig. 3). Patients who believed that cancer caused their pain (the 'believers') rated their present pain intensity (mean $= 5.82$) significantly higher after physical therapy than did those who attributed their pain to other factors (mean $= 3.76$, $t(30) = 2.16$, $P < 0.05$). The pre-to-post increase in pain intensity after physical therapy was marginally greater for the 'believers' than for the others, $t(30) = 1.99$, $P = 0.06$. The 'believers' also rated their pain affect (mean $= 3.18$) after physical therapy as significantly higher than the others (mean $= 1.62$, $t(30) = 2.11$, $P < 0.05$), but the pre-to-post change in present pain affect between the two groups was not significant, $t(30) = 0.22$, $P > 0.05$. The two groups also did not differ significantly in ratings of positive or negative mood after physical therapy (both $P > 0.05$).

Fig. 2. Dissociation of mean pain intensity and mean pain affect ratings.
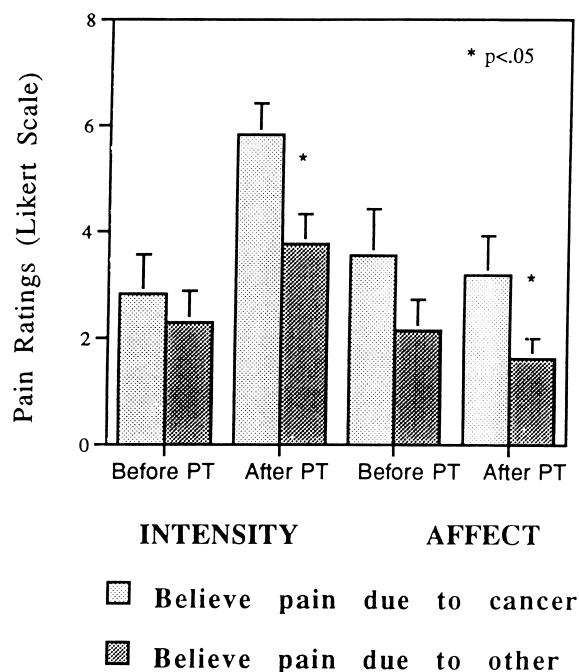

Fig. 3. The effect of physical therapy on ratings of mean pain intensity and mean pain affect of subjects who believe their pain is due to cancer and subjects who believe their pain is caused by factors other than cancer.

3.4. Effects of present pain on recall

3.4.1. Equivalence of groups prior to physical therapy

The Pre-PT Recall group (patients who were randomly selected to recall past pain experience prior to physical therapy) and the Post-PT Recall group (patients who were randomly selected to recall past pain experience after physical therapy) did not differ significantly prior to therapy on either present pain intensity or present pain affect. The Post-PT Recall patients reported a somewhat higher positive mood (mean = 6.56) than the Pre-PT Recall patients (mean = 4.94, $t(30) = -1.91$, $P = 0.07$), as well as a significantly lower negative mood (mean = 2.0 vs. mean = 4.13, $t(30) = 2.42$, $P < 0.05$).

3.4.2. Pain and mood states at time of recall

At the time of recall, the Post-PT Recall group (mean = 4.38) was experiencing marginally higher levels of pain intensity than the Pre-PT Recall group (mean = 2.69, $t(30) = -1.72$, $P < 0.10$). The two groups did not report significantly different levels of pain affect, mean (Post-PT Recall) = 1.69, mean (Pre-PT Recall) = 3.0, $t(30) = 1.52$, $P > 0.05$). The Post-PT Recall group reported a significantly more positive mood (mean = 7.13) than the Pre-PT Recall group (mean = 4.94, $t(30) = -2.92$, $P < 0.01$), and a significantly less negative mood (mean = 1.19) than the Pre-PT Recall group (mean = 4.13, $t(30) = 4.05$, $P < 0.01$) at recall.

3.4.3. Recall of pain intensity and pain affect

Patients were asked to recall and rate their usual, highest and lowest pain intensity and pain affect for the previous 3 days. We had expected the Pre-PT and Post-PT groups to differ significantly on pain intensity and pain affect at the time of recall and then to compare the two groups on what they recalled. However, because the two groups were not significantly different on either measure, we combined subjects into one group in order to examine the relationship between current and recalled levels of pain intensity and pain affect (see Table 2). The results strongly support assimilation effects, as there were positive correlations between present levels of pain intensity and recalled levels of usual pain intensity ($r = 0.71$, $P < 0.01$)) and usual pain affect ($r = 0.55$, $P < 0.01$), as well as positive correlations between present pain affect and recalled levels of usual pain intensity ($r = 0.66$, $P < 0.01$) and usual pain affect ($r = 0.67$, $P < 0.01$).

The correlations for the Post-PT group provide further evidence of the assimilative effects of present pain levels. Recalled usual pain intensity was positively correlated ($r = 0.66$, $P < 0.01$) with present pain intensity after therapy at the time of recall, but was uncorrelated with the pain intensity which these subjects reported prior to physical therapy ($r = 0.09$, $P > 0.05$). These two correlations are significantly different from each other, ($z = 2.14$, $P < 0.05$) (Meng et al., 1992). Thus, recalled pain intensity was only assimilated to present pain intensity at the actual time of recall. The lack of association between recalled pain intensity and pain intensity at some other time suggests that the observed assimilation was not merely an artefact of patients always reporting and recalling pain intensity as consistently high or consistently low. Instead, what the Post-PT patient recalled was correlated with that patient's present, not prior, state of pain.

4. Discussion

The present study found a physical therapy-induced dissociation in the ratings of the sensory and affective dimensions of chronic pain in cancer patients. The physical therapy lead to higher ratings of both pain intensity and pain affect in those patients who believed that their pain was due to cancer. Patients' recall of usual pain intensity and affect was assimilated to their present levels of pain intensity and affect.

4.1. Dissociation of pain intensity and pain affect

Even though physical therapy increased patients' pain intensity, it did not increase the unpleasantness of that pain. Although reported levels of pain intensity and pain affect were highly correlated, this is apparently the first experimental demonstration of a dissociation between pain intensity and affect for chronic pain patients. This dissociation strongly supports the conclusion that pain intensity and

Table 2

Correlations between measures of present pain and recalled pain

Recall variables	Present pain intensity			Present pain affect		
	Pre-PT	Post-PT	Combined	Pre-PT	Post-PT	Combined
Usual pain intensity	0.78**	0.67**	0.71**	0.83 **	0.50	0.66**
Highest pain intensity	0.75**	0.42	0.59	0.75****	0.24	0.53*
Lowest pain intensity	0.74**	0.77**	0.49**	0.77**	0.73**	0.79**
Usual pain affect	0.73**	0.43*	0.55**	0.79**	0.49*	0.67**
Highest pain affect	0.53**	0.19	0.32	0.58**	0.26	0.48**
Lowest pain affect	0.88**	0.53**	0.52**	0.90**	0.74**	0.88**

*$P < 0.05$, **$P < 0.01$, significance of r.

pain affect are separable but not independent dimensions of pain reports (Fernandez and Turk, 1992; Gracely, 1992; Price and Harkins, 1992) and that one should assess both dimensions when measuring pain. Research measuring only pain intensity may miss clinically relevant aspects of pain and fail to measure aspects of pain that are meaningful to patients.

This dissociation may reflect the influence of the context in which the increased pain intensity occurred. Physical therapy is clearly a therapeutic intervention. Movements in one's daily environment that might replicate those in therapy, such as raising an arm or ascending a flight of stairs, would likely result in increases in both pain intensity and affect. Similar movements done with a caring health care provider in a therapeutic environment slightly decreased reported pain affect. The therapeutic context of the pain increase may also be responsible for the change in mood following the physical therapy. Even though the therapy increased pain intensity, the patients' positive mood increased and negative mood decreased. Intensity and affective dimensions may be less easily dissociated in normal subjects who experience experimentally-induced changes in acute pain. These results suggest the importance, if not the necessity, of using patients who experience changes in their naturally-occurring pain when studying the affective dimension of pain (Price and Harkins, 1992).

4.2. Beliefs about pain etiology

Patients' beliefs about the etiology of their pain influenced their post-therapy ratings. The 11 patients who attributed their pain to cancer rated their pain after therapy as more intense and more unpleasant than did the 21 patients who did not attribute their pain to cancer. While all patients acknowledged having cancer, it is possible that some of the 11 believers had idiosyncratically attributed their pain to cancer and that some of the 21 non-believers were unwilling to admit a linkage between their pain and cancer. However, the two groups did not differ significantly on any other pre- or post-therapy ratings. Also the diagnoses of patients were roughly the same in both groups, and so it is unlikely that merely expressing different beliefs about the etiology of their pain led to their receiving different intensities of physical therapy.

The patient's causal model of pain and cancer (Nerenz and Leventhal, 1983; Cioffi, 1991) impacts on an affective dimension of pain which can not be studied in typical laboratory research. Experimentally-induced pain has no comparable appraised meaning for normal healthy volunteers. The physical therapy-induced pain is rated as more intense and distressing perhaps because subjects may believe that the pain is a signal for their life-threatening cancer. For the other 21 patients, the pain was viewed as unrelated to the cancer and perhaps also as relatively non-threatening compared to the cancer.

4.3. Effect of present pain on recall

The marginal difference between the Pre-PT and Post-PT groups on present pain intensity at the time of recall probably reflects a lack of statistical power. With a larger study sample, significant differences between groups on present pain intensity would be expected and statistical analyses of group means would be possible. However, correlational analyses using subjects in both groups did suggest that the recall of past pain intensity and affect was assimilated to the present pain intensity and affect. This is the first study to demonstrate these assimilation effects after an experimentally induced increase in present pain experienced by chronic pain patients. Furthermore, for the Post-PT group, this assimilation was not simply an artefact of a patient's response style. None of the patients had kept a pain diary, and so the assimilation effects were not the result of their trying to recall previous records. Similar assimilation effects have occurred in research where comparisons with previous records were possible (Smith and Safer, 1993).

These results demonstrated the importance in pain research of measuring both the intensity and affective dimensions of pain, and the influence of the appraised meaning of pain on the rating of these dimensions. Research designed to investigate clinical pain syndromes is generally based on conclusions from research conducted with normal subjects experiencing experimental pain. It is unlikely that the dissociation between present pain intensity and affect and the influence of the patient's belief in the etiology of their pain on ratings of present pain would have been demonstrated with normal volunteers in an experimental setting. The results clearly suggest the importance of using actual patients who experience changes in their naturally occurring pain.

Acknowledgements

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